IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of **Vanghi**	PATENT PENDING
Serial No.: **09/918,020**	Examiner: Jung H. Park
Filed: **30 July 2001**	Group Art Unit: 2661
For: **FAST FLOW CONTROL METHODS FOR COMMUNICATION NETWORKS**	Confirmation No.: 1043
Docket No: **4740-007/ P12790-US1**	

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7 June 2006
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Season Munck

RESPONSE TO OFFICE ACTION

This paper is being filed in response to the Office Action mailed 7 March 2006, having a reply due date of 7 June 2006. Reconsideration and reexamination are respectfully requested in light of the amendments and remarks below. While no fees should be required for entry of this response, if any fees or charges are required, the Commissioner is hereby authorized to charge them to Deposit Account 18-1167.

AMENDMENTS TO THE CLAIMS

1. (Original) A method of reverse link flow control for a sector in a high rate packet data network serving a plurality of access terminals, said method comprising:

determining an individual interference contribution of each access terminal served by said sector based on a reverse data channel rate of said access terminal;

estimating total sector interference for said sector based on said individual interference contributions of said access terminals; and

setting a reverse link flow control indicator regulating the reverse data channel rates used by said access terminals based on said total sector interference.

2. (Original) The method of claim 1 wherein determining an individual interference contribution of each access terminal served by said sector based on said reverse data channel rate of said access terminal comprises:

determining channel gains for selected reverse link channels from said access terminal; and

weighting said channel gains by a pilot signal-to-noise ratio (pilot SNR) for said access terminal.

3. (Original) The method of claim 2 further comprising determining said pilot SNR by estimating a nominal pilot SNR value.

4. (Original) The method of claim 3 further comprising weighting said individual interference contribution by a scaling factor based on a packet error rate of said access terminal.

5. (Original) The method of claim 2 further comprising determining said pilot SNR by measuring pilot SNR for said access terminal.

6. (Original) The method of claim 2 wherein determining channel gains for selected reverse channels from said access terminal comprises determining a reverse data channel gain and a reverse data rate control channel gain.

7. (Original) The method of claim 6 wherein determining a reverse data channel gain and a reverse data rate control channel gain comprises accessing pre-defined channel gain value information.

8. (Original) The method of claim 7 wherein accessing pre-defined channel gain value information comprises accessing stored channel gain value information comprising predefined gain values corresponding to said reverse data channel gain and said reverse data rate control channel gain.

9. (Original) The method of claim 8 further comprising selecting one of a number of defined gain values stored for said reverse data channel gain in said stored channel gain value information based on said reverse data channel rate of said access terminal.

10. (Original) The method of claim 7 wherein an air interface standard used by said network specifies said channel gains for said selected reverse channels, and further comprising configuring said stored channel gain values based on said air interface.

11. (Original) The method of claim 2 wherein weighting said channel gains by a pilot signal-to-noise ratio (pilot SNR) for said access terminal comprises multiplying a sum of said channel gains for said selected reverse channels by said pilot SNR.

12. (Original) The method of claim 1 wherein determining total sector interference for said sector based on said individual interference contributions of said access terminals comprises summing said individual contributions for all said access terminals served by said sector.

13. (Original) The method of claim 1 further comprising compensating said estimate of total interference for soft handoff, wherein one or more of said access terminals served by said sector may be in soft handoff with one or more other sectors in said network.

14. (Original) The method of claim 13 wherein compensating said estimate of total interference for soft handoff comprises scaling said individual contributions by a weighting factor based on packet error rates of said access terminals.

15. (Original) The method of claim 14 wherein scaling said individual contributions by a weighting factor based on packet error rates of said access terminals comprises:

determining a packet error rate of each access terminal;

setting said weighting factor based on said packet error rate; and

scaling said individual contribution of said access terminal by said weighting factor.

16. (Original) The method of claim 15 wherein setting said weighting factor based on said packet error rate comprises setting said weighting factor to a first value if said packet error rate is below an error threshold and to a second value if said packet error rate is said error threshold.

17. (Original) The method of claim 1 wherein setting a reverse flow control indicator regulating the reverse data channel rates used by said access terminals based on said total sector interference comprises:

determining a remaining reverse capacity based on said total sector interference; and

setting said reverse flow control indicator to indicate a busy condition when said reverse capacity falls below a reserve capacity threshold.

18. (Original) The method of claim 1 wherein setting a reverse flow control indicator regulating the reverse data channel rates used by said access terminals based on said total sector interference comprises setting said reverse flow indicator to indicate a busy condition when said estimate of total interference is above a first threshold, and setting said reverse flow indicator to indicate a not busy condition when said estimate of total interference returns below a second threshold lower than said first threshold.

19. (Original) The method of claim 1 further comprising sending said estimate of total interference to a central controller operative to perform inter-sector reverse link flow control based on said estimate of total interference from said sector and one or more other estimates of total interference from one or more other sectors in said network.

20. (Original) The method of claim 19 further comprising sending estimated frequency reuse efficiency to said central controller for use in inter-sector reverse link flow control.

21. (Original) The method of claim 20 further comprising determining said estimated frequency reuse efficiency for said sector by estimating a first number of access terminals

contributing to outer-cell interference in said sector, and a second number of access terminals contributing to in-cell interference in said sector.

22. (Original) The method of claim 21 wherein estimating a first number of access terminals contributing to outer-cell interference in said sector, and a second number of access terminals contributing to in-cell interference in said sector comprises evaluating a pilot channel signal-to-noise ratio for each said access terminal to determine whether said access terminal belongs to said first number or said second number.

23. (Original) The method of claim 21 wherein estimating a first number of access terminals contributing to outer-cell interference in said sector, and a second number of access terminals contributing to in-cell interference in said sector comprises evaluating a packet error rate (PER) for each said access terminal to determine whether said access terminal belongs to said first number or said second number.

24. (Original) The method of claim 21 wherein determining said estimated frequency reuse efficiency for said sector by estimating a first number of access terminals contributing to outer-cell interference in said sector, and a second number of access terminals contributing to in-cell interference in said sector comprises computing a ratio of total interference to in-cell interference, wherein said total interference comprises total outer-cell interference and total in-cell interference, and further comprising computing said total outer-cell and total in-cell interference based on said first and second numbers.

25. (Original) The method of claim 24 wherein computing said outer-cell and in-cell interference based on said first and second numbers comprises summing individual interference

contributions for said access terminals belonging to said first number as said total outer-cell interference.

26. (Original) The method of claim 24 wherein computing said outer-cell and in-cell interference based on said first and second numbers comprises summing individual interference contributions for said access terminals belonging to said second number as said total in-cell interference.

27. (Currently Amended) A method of reverse link flow control in a wireless communication network comprising a plurality of sectors, the method comprising regulating reverse link data rates for access terminals in a first sector in dependence on a ~~sector~~ measured reverse link loading of a second sector to reduce reverse link interference in said second sector caused at least in part by said access terminals controlled by said first sector.

28. (Original) The method of claim 27 further comprising cooperatively regulating reverse link data rates for a plurality of access terminals served by a plurality of sectors in said network, including said first and second sectors, to improve reverse link capacity utilization for at least one of said plurality of sectors.

29. (Currently Amended) The method of claim 27 wherein regulating reverse link data rates for access terminals in a first sector in dependence on ~~a sector~~ the reverse link loading of [[a]] the second sector to reduce reverse link interference in said second sector caused at least in part by said access terminals controlled by said first sector comprises:

estimating total sector interference in said second sector; and

causing said first sector to reduce reverse link data rates for at least some of said access terminals controlled by said first sector if said sector interference in said second sector exceeds a defined threshold, thereby reducing said total sector interference in said second sector.

30. (Original) The method of claim 29 wherein estimating said total sector interference in said second sector comprises:

determining an individual interference contribution of each access terminal served by said sector based on a reverse data channel rate of said access terminal; and

estimating said total sector interference for said sector based on said individual interference contributions of said access terminals.

31. (Original) The method of claim 30 wherein determining an individual interference contribution of each access terminal served by said sector based on said reverse data channel rate of said access terminal comprises:

determining channel gains for selected reverse link channels from said access terminal; and

weighting said channel gains by a pilot signal-to-noise ratio (pilot SNR) for said access terminal.

32. (Original) The method of claim 31 wherein determining channel gains for selected reverse channels from said access terminal comprises determining a reverse data channel gain and a reverse data rate control channel gain.

33. (Original) The method of claim 32 wherein determining a reverse data channel gain and a reverse data rate control channel gain comprises accessing pre-defined channel gain value information.

34. (Original) The method of claim 29 wherein causing said first sector to reduce reverse link data rates for at least some of said access terminals controlled by said first sector comprises adjusting a defined threshold for total sector interference used by said first sector to regulate reverse link data rates of said access terminals served by said sector.

35. (Original) A method of reverse link flow control in a wireless communication network comprising a plurality of sectors, the method comprising:

receiving total sector interference estimates indicative of sector loading from a plurality of sectors within said network at a central processor;

controlling reverse link throughput in at least a first sector in dependence on said interference estimates of at least a second sector to reduce interference in at least said second sector.

36. (Original) The method of claim 35 wherein controlling reverse link throughput in at least a first sector in dependence on said interference estimates of at least a second sector to reduce interference in at least said second sector comprises adjusting one or more flow control parameters used by said first sector in regulating reverse link data rates of access terminals controlled by said first sector.

37. (Original) The method of claim 36 wherein adjusting one or more flow control parameters used by said first sector in regulating reverse link data rates of access terminals controlled by

said first sector comprises adjusting one or more interference thresholds used by said first sector in determining whether a current level of estimated total sector interference for said first sector necessitates indicating a busy condition to said access terminals controlled by said first sector, which indication causes at least some of said access terminals to reduce their reverse link data rates.

38. (Original) The method of claim 37 wherein adjusting one or more interference thresholds used by said first sector comprises transferring one or more updated interference threshold values to said first sector.

39. (Original) The method of claim 35 wherein controlling reverse link throughput in at least a first sector in dependence on said interference estimates of at least a second sector to reduce interference in at least said second sector comprises causing a radio base station in said first sector to reduce reverse link data rates for at least some of said access terminals controlled by said first sector to reduce interference in said second sector.

40. (Original) The method of claim 35 further comprising inter-dependently controlling reverse link throughputs in one or more of said plurality of sectors, including said first and second sectors, to reduce inter-sector interference.

41. (Original) The method of claim 40 further comprising inter-dependently controlling reverse link throughputs of said plurality of sectors to increase a total network reverse link throughput.

42. (Original) The method of claim 35 wherein controlling reverse link throughput in at least a first sector in dependence on said interference estimates of at least a second sector to reduce interference in at least said second sector comprises:

evaluating said total interference estimates from said plurality of sectors;

adjusting interference threshold values used by one or more of said plurality of sectors in regulating reverse link data rates of pluralities of access terminals respectively served by said one or more of said sectors to minimize inter-sector interference; and

sending said adjusted interference thresholds to respective ones of said one or more of said sectors.

43. (Original) The method of claim 35 further comprising receiving frequency reuse efficiency estimates from said plurality of sectors.

44. (Original) The method of claim 43 further comprising controlling reverse link throughput in one or more sectors, including said first sector, in dependence on said interference estimates and said efficiency estimates from one or more other sectors, including said second sector.

45. (Original) The method of claim 43 further comprising:

identifying a sector in said plurality of sectors having a reserve reverse link capacity below a defined threshold, as indicated by said interference estimate for said sector, and having a high frequency reuse efficiency, as indicated by said efficiency estimate for said sector; and

causing one or more other sectors in said plurality of sectors that are adjacent to said identified sector to reduce their reverse link throughput, thereby reducing interference in said identified sector.

46. (Original) The method of claim 43 wherein receiving frequency reuse efficiency estimates from said plurality of sectors comprises receiving one of said efficiency estimates from a radio base station in each one of said plurality of sectors at a central processor in a base station controller controlling said radio base stations in said plurality of sectors.

47. (Original) The method of claim 46 wherein receiving said interference estimates from said plurality of sectors comprises receiving said interference estimates from said radio base stations.

48. (Original) The method of claim 47 wherein each one of said radio base stations regulates reverse link throughput for the corresponding sector based on setting a reverse activity indicator, and further comprising controlling reverse link throughput in one or more of said sectors in inter-dependent fashion based on said interference estimates and said efficiency estimates.

49. (Original) The method of claim 48 wherein controlling reverse link throughput in one or more of said sectors in inter-dependent fashion based on said interference estimates and said efficiency estimates comprises transmitting adjusted interference threshold values used by said radio base stations in setting said reverse activity indicator.

50. (Original) A radio base station regulating reverse link data rates for a plurality of access terminals, said radio base station comprising:

a plurality of radio interfaces to support a plurality of connections with said access terminals;

a processing system to estimate total sector interference by determining individual interference contributions for said plurality of access terminals using defined channel gain information;

a threshold detector to generate a control signal by evaluating said estimated total sector interference with respect to a capacity threshold; and

a reverse activity modulator to set a reverse activity indicator to a busy or not busy state responsive to said control signal.

51. (Original) The radio base station of claim 50 further comprising a demodulation circuit in each one of said radio interferences to provide pilot channel signal to noise ratio information to said processing system for the connection corresponding to said radio interference, and wherein said processing system uses said pilot channel signal to noise ratio information in determining said individual interference contributions for said connections.

52. (Original) The radio base station of claim 50 further comprising a storage element operative to be hold said defined channel gain information, thus permitting said processing system to access said defined channel gain information for estimating said individual interference contributions.

53. (Currently Amended) A base station controller for use in a wireless communication network employing reverse link flow control, said base station controller comprising a central processor programmed to:

receive estimates of reverse link loading for a sector ~~loading estimates~~ from a plurality of radio base stations; and

process said ~~sector loading~~ estimates of reverse link loading from said plurality of radio base stations to compute a flow control parameter for one or more of said radio base stations;

wherein said flow control parameter computed for each radio base station is dependent on an estimate of reverse link loading for a sector associated with ~~loading estimate for~~ at least one other radio base station.

54. (Original) The base station controller of claim 53 wherein said central processor is further programmed to:

receive frequency reuse efficiency estimates from said radio base stations; and

process said efficiency estimates in conjunction with said loading estimates to compute said flow control parameters for said one or more of said radio base stations.

55. (Currently Amended) The base station controller of claim 54 wherein said central controller is programmed to process said efficiency estimates in conjunction with said estimates of reverse link loading ~~estimates~~ to compute said flow control parameters for said one or more of said radio base stations based on being programmed to:

identify one or more first radio base stations having high estimates of reverse link loading ~~estimates~~ and high efficiency estimates; and

compute flow control parameters for one or more second radio base stations adjacent to said one or more first radio base stations, such that interference at said first radio base stations caused by access terminals controlled by said second radio base stations is reduced.

56. (Original) The base station controller of claim 53 wherein said central controller is further programmed to send said flow control parameters to said radio base stations.

REMARKS

In the Office Action mailed 7 March 2006, the examiner allowed claims 50 – 52, but rejected claims 27 – 34 and 53 – 56 under 35 U.S.C. §112, 2nd paragraph, independent claims 27 and 35 under 35 U.S.C. §102, and independent claim 1 under 35 U.S.C. §103. In response, the applicant offers the following remarks and the enclosed amendments.

§112 Rejection

The examiner rejected claims 27 – 34 and 53 – 56 under §112, 2nd paragraph, as being indefinite because the meaning of "sector loading estimates" is unclear. First, the applicant notes that claims 27 – 34 do not include the phrase "sector loading estimates." As such, the examiner's rejection of claim 27 is unclear. Further, a careful reading of the specification reveals that the phrases "sector loading" and "sector loading estimate" refer to a reverse link load or capacity of a particular sector and an estimate of a reverse link load or capacity of a particular sector, respectively. As such, when read in light of the specification, the phrases "sector loading" in claims 27 – 34 and "sector loading estimates" in claims 53 – 56 are clear and satisfy the requirements of §112, 2nd paragraph. However, to facilitate prosecution, the applicant amends claims 27, 29, 53, and 55 to explicitly claim the reverse link loading of a sector. The applicant respectfully requests reconsideration and withdrawal of the §112 rejections.

§102 Rejections

The examiner rejected independent claim 27 under §102(e) as anticipated by Chung (US2002/0151310). Independent claim 27 claims a method of regulating reverse link data rates for access terminals in a first sector based on reverse link loading of a second sector. In so doing, the method of claim 27 reduces reverse link interference in the second sector caused by

the access terminals in the first sector. It is important to note that the method of claim 27 specifically claims controlling data rates for mobile stations in the first sector to control interference in a different sector caused by the access terminals in the first sector.

In direct contrast, Chung shows an equation for calculating the reverse link capacity in a given network cell. The calculation considers interference seen by the cell's reverse link receiver arising from mobile stations in the cell and from mobile stations in other cells. Describing a process whereby a given base station receiver calculates its own interference conditions based on interference coming from in-cell mobile stations and out-of-cell mobile stations, as Chung does, has nothing to do with the limitations plainly included in claim 27.

Namely, claim 27 explicitly claims a method wherein the reverse link data rates of mobile stations in one sector (or cell) are controlled in dependence on the reverse link loading measured in another sector (or cell), for the purpose of reducing reverse link interference in that other sector or cell. Chung simply says that interference calculations done for one cell must consider the interference caused by mobile stations operating in other cells--Chung teaches or suggests utterly nothing relevant to the claimed method of controlling reverse link data rates of mobile stations in one sector or cell for the express purpose of reducing reverse link interference in another sector or cell, based on measured reverse link loading in that other sector or cell.

Further, contrary to the examiner's assertions, the data rate calculations in ¶ [0052] of Chung are not dependent on a measured reverse link loading of a second sector, as required by claim 27. Instead, Chung determines the loading based on a total interference computed by multiplying a calculated in-cell interference by an interference factor, β (¶ [0049] – [0054]). As described in ¶ [0049], β denotes a fixed interference factor, such as 0.6 or 0.85. As such, β does not correspond to any measured value.

Because nothing in Chung actually teaches or suggest regulating reverse link data rates for access terminals in a first sector based on the measured reverse link loading of the second sector to reduce interference in the second sector caused at least in part by the access terminals in the first sector, as required by claim 27, Chung does not anticipate independent claim 27. Therefore, independent claim 27 and dependent claims 28 – 34 are patentably distinct from the cited art. The applicant respectfully requests reconsideration.

The examiner also rejects independent claim 35 under §102(b) as anticipated by Cheda. Claim 35 claims a method of controlling reverse link throughput in a first sector based on interference estimates for a second sector received at a central processor. Contrary to the examiner's assertions, Cheda has nothing to do with controlling throughput in one sector based on interference estimates associated with another sector. In fact, Cheda does not describe estimating or otherwise measuring any type of actual interference. Instead, Cheda describes a method and apparatus for improving the link capacity through <u>intelligent antenna design</u> for specific sectors. More particularly, for each sector Cheda describes using antennas with a narrow horizontal beamwidth as transmit antennas and/or hybrid transmit/receive antennas, and using antennas with a wide horizontal beamwidth as receive antennas. See at least the Abstract and Summary. Such teachings have nothing to do with controlling reverse link throughput in one sector <u>based on interference estimates received for another sector</u>.

In the pending office action, the examiner asserts that col. 2, ll. 25 – 42 of Cheda specifically anticipates claim 35. The cited section describes how the maximum capacity (number of users per sector) may be estimated based on a frequency reuse factor, which is defined as the ratio of the interference from access terminals within a sector to the total interference from all access terminals in all sectors. This information simply illustrates a relationship between interference and capacity, and provides support for the subsequent discussion regarding the impact of sector antenna design on interference. Nothing in Cheda

ever actually uses measured or estimated interference for one sector to control reverse link throughput in another sector.

For at least these reasons, independent claim 35 and dependent claims 36 – 49 are patentably distinct from Cheda. The applicant respectfully requests reconsideration.

§103 Rejections

The examiner rejects independent claim 1 under §103 as obvious over Chung in view of Cheda. On page 5 of the office action, the examiner concedes that Chung does not teach the claimed step of estimating the total sector interference from access terminals within the sector. For this teaching, the examiner relies on Cheda. However, as discussed above, Cheda only illustrates a relationship between the frequency reuse factor and the sector capacity. Nothing in Cheda teaches or suggests estimating or measuring the actual frequency reuse factor. Further, nothing in Cheda teaches or suggests estimating or measuring the actual interference for one sector or the total network interference used to define the frequency reuse factor. As such, even if (*arguendo*) there is motivation to combine Chung with Cheda, Cheda does not solve the admitted deficiencies of Chung.

Further, neither Chung nor Cheda teach or suggest estimating a total sector interference based on individual interference contributions from access terminals in the sector. The examiner asserts that the total sector interference is "a simple summation of individual interference." While this may be true, nothing in Chung or Cheda teaches this type of summation or even has any use for the result of such a calculation[1]. Therefore, the skilled user would not be motivated to modify Chung or Cheda to compute the total sector interference from individual interference estimates.

[1] As noted above, Cheda does not use interference estimations and Chung teaches using an interference factor to compute a total interference.

Further, because Cheda's frequency reuse factor is solely described in terms of antenna design and selection and not in terms of any type of reverse link capacity calculation, as described in Chung, the skilled user would not be motivated to look to Cheda to solve the problems of Chung.

For at least these reasons, independent claim 1 and dependent claims 2 – 26 are non-obvious over Chung, Cheda, or any combination of Chung with Cheda. The applicant respectfully requests reconsideration.

Summary

The above remarks and enclosed amendments address the §112 rejections cited against independent claims 27 and 53, the §102 rejections cited against independent claims 27 and 35, and the §103 rejection cited against independent claim 1. The applicant notes with appreciation that the examiner allowed claims 50 – 52. Therefore, in light of the above remarks, claims 1 – 56 stand in condition for allowance. The applicant respectfully requests that the examiner reconsider the rejections and issue a notice of allowance. Should any issues remain, the applicant requests that the examiner contact the undersigned so that any such issues may be expeditiously resolved.

Respectfully submitted,

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